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# Volume Tables and Point-Sampling Factors

*for*

## *Lodgepole Pine in Colorado and Wyoming*

by

Clifford A. Myers

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VOLUME TABLES AND POINT-SAMPLING FACTORS  
FOR LODGEPOLE PINE  
IN COLORADO AND WYOMING

by

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<sup>1</sup> Central headquarters maintained in cooperation with Colorado State University at Fort Collins.



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# Volume Tables and Point-Sampling Factors

## for Lodgepole Pine

### in Colorado and Wyoming

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#### INTRODUCTION

The tables presented here give values needed to determine the volumes of lodgepole pines (*Pinus contorta* Dougl.) in Colorado and Wyoming. They provide timber cruisers and growth estimators with the following:

1. Gross volumes in total and merchantable cubic feet,
2. Gross volumes in board feet, International 1/4-inch and Scribner log rules,
3. Point-sampling factors for merchantable cubic feet and board feet, and
4. Distribution of board-foot volume among the logs of a tree.

Volume on an area may be determined from:

1. Measurements of tree diameters and heights,
2. Measurements of diameters and of sufficient heights to convert the appropriate volume tables to local volume tables (Chapman and Meyer, 1949),<sup>2</sup> or
3. Tree counts obtained by point-sampling.

<sup>2</sup> Names and dates in parentheses refer to Literature Cited, p. 4.

Sample trees were measured in all major areas of commercial lodgepole pine in Colorado and Wyoming.

#### DEFINITIONS AND STANDARDS

Definitions of variables used in the tables, and of standards followed in field measurement and computations, are as follows:

Diameter breast high (d.b.h.).--Measured to 0.1 inch outside bark 4.5 feet above average ground level. In the tables, full-inch diameter classes, with class midpoints at the half-inch marks, were used (12.5, 13.5, etc.).

Scaling diameter of logs.--Average diameter inside bark to 0.1 inch, measured at the upper (small) end of logs or half-logs. Saw-log diameter classes followed conventional scaling practice, with the class midpoints at whole inches (8.0, 9.0, etc.).

Minimum top diameter of sawtimber trees.--Diameter inside bark, 8 inches. Logs with a scaling diameter less than 7.6 inches (8-inch class) usually were not included in saw-log volume. A few logs with a scaling diameter of 7 inches were included to satisfy requirements of the 4-foot rule described with the

definition of height in logs, below. This also conforms to local practice.

Total height.--Measured to the nearest foot from average ground level at the tree base upward to the tip. Forked, stag-topped, or other deformed trees were not included in the sample. Midpoints of the total height classes used in the tables were multiples of 10.0 feet, as 10.0, 20.0, etc.

Height in logs.--Measured from the top of a stump 1.0 foot high upward to the limit of saw-log utilization. Each tree was divided into as many standard 16.3-foot-long logs as possible. An additional half-log, if present, was taken from the uppermost part of the merchantable length. Portions of the bole above the height of minimum top saw-log diameter were included in the uppermost saw log if the standard length of the log or half-log ended within 4.0 feet above this height. This "4-foot rule" was used to avoid biased negative error in volume (Chapman and Meyer, 1949).

## EXPLANATION OF TABLES

The general definitions and standards given apply to all tables. Explanation of each type of table and suggestions for use are presented here.

### Volume Tables

Headings and footnotes with each volume table (tables 1, 2, 4, 6, 8, 10) give the volume unit, type of height measurement, utilization standards, and volume equations used in its compilation. Ten-foot or half-log height classes and full-inch diameter classes were used in all tables.

The volume tables were derived from linear regressions in  $V$  and  $D^2 H$ , of the form:

$$V = a + b D^2 H$$

where

$V$  = gross volume in the appropriate unit

$D$  = diameter breast high outside bark

$H$  = total height in feet or in standard logs and half-logs

$a, b$  = regression constants

Two equations were used to derive each table; the relationship between  $V$  and  $D^2 H$  could not be expressed by a single linear regression over the full range of the basic data. Correlation coefficients ( $r$ ) of the 12 volume equations ranged from 0.908 (board feet with total height) to 0.990 (total cubic feet).

The number of logs in a tree shown in the tables is not necessarily the number that will actually be cut from it. Instead, it is the number of logs between the stump and the height where minimum top diameter is reached. To locate the minimum top, the 4-foot rule previously explained under "Height in logs" should be used.

Volume of nonmerchantable logs below the height of minimum top diameter should be deducted by estimation of scaling diameters, use of taper tables, or according to the percentages in table 13. Volume must not be reduced by tallying fewer logs in the tree. For example, assume that a sound tree 18 inches in diameter has a bole length of 65.2 feet (4 logs) between the stump and the height where diameter inside bark is 8 inches. The tree has a gross volume of 364 board feet Scribner rule (table 6). The top log is too limby to send to the sawmill. This log contains 8 percent of the board feet in the tree (table 13) and the other logs contain 92 percent. When 8 percent or 29 board feet is deducted, the tree contains 335 board feet. If the tree were tallied as an 18-inch, 3-log tree, it would be incorrectly credited with a volume of 275 board feet. Alternatively, the top log has a scaling diameter of 8 inches, thus 32 board feet (Scribner log rule) could be deducted from the volume of an 18-inch, 4-log tree.

## POINT-SAMPLING FACTORS

The first five tables of point-sampling factors (tables 3, 5, 7, 9, 11) give the factors for each of numerous combinations of tree diameter and height. Volumes per square foot of basal area were obtained from the equations in the table footnotes. These equations resulted from the division of each volume equation (tables 2, 4, 6, 8, 10) by  $0.005454 D^2$ , a formula for basal area ( $B$ ).



Table 12 was derived from the other tables of point-sampling factors. The factor for each height class is the weighted average of the factors in that class given in table 2, 4, 6, 8, or 10. Weights were obtained from random samples of heights and diameters in stands of commercial lodgepole pine in Colorado and Wyoming.

Point-sample cruising for volume can be done in several ways:

1. Diameters and heights of trees counted through the prism or relascope may be measured,
2. Diameters may be estimated and heights measured, or
3. Heights of the counted trees may be measured and no record made of tree diameters.

The procedure selected will depend on the accuracy desired (relative accuracy usually in the order listed above) and the time and personnel available for the job. Point-sampling factors are provided for each alternative.

The diameter and height of each counted tree may be measured and a volume conversion factor selected for each combination of diameter and height (tables 3, 5, 7, 9, 11). Volume per acre is computed as follows:

1. Multiply the number of counted trees in each diameter-height class by the point-sampling factor for the class.
2. Total the products of step one.
3. Multiply this total by the basal area factor of the prism or other angle gage used.
4. Divide the product of step three by the number of points sampled on the tract.

Time can often be saved if the heights of the counted trees are measured while diameters are estimated and tallied by broad diameter classes. Inspection of the tables shows that volumes per square foot of basal area often do not differ greatly among trees of a single height class. For example, the merchantable volumes of trees 70 feet tall vary from 29.6 to 33.8 cubic feet per square foot over a range in diameter of 5 to 24 inches (table 3). Board feet per square foot of basal area changes little with diameter when tree

heights are measured in logs (tables 7, 11). Therefore, the increased time spent measuring diameters may not result in any material increase in accuracy.

Measurement of heights with no record made of diameters is recommended when there is little change in volumes per square foot within a height class. Point-sampling factors in table 12, based on height only, will be most useful where the distributions of diameters within height classes approximate those used in preparation of the tables. Differences in the relationship between height and diameter due to differences in site quality or stand density may change the factor for each height class. These changes may be accounted for by computing new factors for each height class, using table 3, 5, 7, 9, or 11 and almost the same procedure used to derive a local volume table from a standard table (Chapman and Meyer, 1949). Diameters are plotted over heights since height will be retained as the measured variable.

The techniques of point sampling have been described in numerous publications. A good discussion of the method was presented by Bonnett (1959). A simple procedure for determination of the number of sampling points (Allen and Mogren, 1960) and precautions on the use of point-sampling on small tracts (Afanasiev, 1958) have been published. Basic American references were prepared by Grosenbaugh (1952, 1955, 1958).

#### Percentage of Tree Board-Foot Volume in Each Log

The board-foot volume in each log-quality class or the volume in cull logs can be determined with the percentages from table 13. Each line in the body of the table gives the distribution of volume among the logs of a tree of specified diameter and merchantable length. For example, in 18-inch, 3-log trees, the butt log contains 55 percent of the board feet, the middle log contains 33 percent, and the top log 12 percent.

Percentages for diameters that are not included in table 13 can be obtained by interpolation.

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Table 1. -- Volumes of entire stem in cubic feet,  
lodgepole pines in Colorado and Wyoming

Cubic feet inside bark

Entire stem including stump and top

Total height above ground

Diameter breast height outside bark (inches)	Total height in feet								Basis: Trees
	30	40	50	60	70	80	90	100	
----- Cubic feet -----									
2	0.55	0.72							0
3	1.05	1.39	1.73						6
4	1.71	2.28	2.84	3.40					22
5	2.55	3.39	4.23	5.07	5.91				33
6	3.55	4.72	5.89	7.07	8.24				25
7	4.71	6.28	7.84	9.40	11.0				34
8	6.05	8.05	10.1	12.1	14.1	16.1			45
9	7.55	10.1	12.6	15.1	17.6	20.3			59
10	9.21	12.3	15.3	18.4	21.4	24.0	26.6		101
11	11.0	14.7	18.4	22.0	25.0	28.1	31.2	34.3	93
12		17.4	21.7	25.3	29.0	32.6	36.2	39.9	69
13		20.4	24.7	28.9	33.2	37.4	41.7	45.9	32
14		23.1	28.0	32.9	37.8	42.7	47.6	52.5	20
15		25.9	31.5	37.1	42.7	48.3	53.9	59.5	9
16			35.2	41.5	47.9	54.2	60.6	66.9	20
17			39.2	46.3	53.4	60.6	67.7	74.9	11
18				51.3	59.3	67.3	75.3	83.3	12
19				56.7	65.5	74.4	83.3	92.1	2
20				62.2	72.0	81.8	91.6	101	1
21				68.1	78.9	89.7	100	111	2
22				74.3	86.1	97.9	110	122	5
23				80.7	93.6	106	119	132	4
24					101	115	129	143	1
25						125	140	155	0
Basis:	14	64	136	176	126	73	15	2	606
No. trees									

Block indicates extent of basic data.

Derived from  $V = 0.002777 D^2 H + 0.027967$ , for  $D^2 H$  to 7,000.

$V = 0.002332 D^2 H + 3.446454$ , for  $D^2 H$  larger than 7,000.

Standard errors of estimate:  $\pm 7.70$  percent;  $\pm 8.17$  percent.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.



Table 2. --Merchantable volumes in cubic feet to a 4.0-inch top,  
lodgepole pines in Colorado and Wyoming

Cubic feet inside bark

Merchantable stem excluding stump and top

Top diameter 4.0 inches inside bark

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet								Basis: Trees
	30	40	50	60	70	80	90	100	
----- Cubic feet -----									
5	1.49	2.34	3.19	4.03	4.88				33
6	2.50	3.68	4.86	6.05	7.23				25
7	3.68	5.25	6.82	8.40	9.97				34
8	5.02	7.04	9.06	11.1	13.1	15.1			45
9	6.53	9.06	11.6	14.1	16.6	19.1			59
10	8.21	11.3	14.4	17.5	20.2	22.7	25.2		101
11	10.1	13.8	17.5	20.7	23.7	26.7	29.7	32.7	93
12		16.4	20.5	24.0	27.5	31.0	34.6	38.1	69
13		19.3	23.4	27.5	31.6	35.7	39.8	44.0	32
14		21.8	26.6	31.3	36.0	40.8	45.5	50.3	20
15		24.5	29.9	35.4	40.8	46.2	51.6	57.0	9
16			33.5	39.7	45.8	52.0	58.1	64.3	20
17			37.4	44.3	51.2	58.1	65.0	71.9	11
18			41.4	49.2	56.9	64.6	72.3	80.0	12
19			45.7	54.3	62.9	71.5	80.0	88.6	2
20				59.7	69.2	78.7	88.2	97.6	1
21				65.4	75.8	86.3	96.7	107	2
22				71.4	82.8	94.2	106	117	5
23				77.6	90.0	103	115	127	4
24					97.6	111	125	138	1
25						120	135	150	0
Basis:									
No. trees	4	47	135	176	126	73	15	2	578

Block indicates extent of basic data.

Derived from  $V = 0.002798 D^2 H - 1.045780$ , for  $D^2 H$  to 7,000.

$V = 0.002256 D^2 H + 2.836222$ , for  $D^2 H$  larger than 7,000.

Standard errors of estimate:  $\pm 9.28$  percent;  $\pm 8.77$  percent.

Diameter classes full inch; e.g., 20-inch class includes 20.0 to 20.9.



Table 3. --Merchantable volumes in cubic feet per square foot of basal area,  
lodgepole pines in Colorado and Wyoming

Cubic feet inside bark

Top diameter 4.0 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet							
	30	40	50	60	70	80	90	100
	----- Cubic feet -----							
5	9.1	14.2	19.3	24.4	29.6			
6	10.9	16.0	21.1	26.2	31.4			
7	12.0	17.1	22.2	27.4	32.5			
8	12.7	17.9	23.0	28.1	33.3	38.4		
9	13.3	18.4	23.5	28.7	33.8	38.8		
10	13.7	18.8	23.9	29.0	33.7	37.8	41.9	
11	13.9	19.1	24.2	28.7	32.9	37.0	41.2	45.3
12		19.3	24.0	28.1	32.3	36.4	40.6	44.7
13		19.4	23.5	27.7	31.8	35.9	40.1	44.2
14		19.0	23.2	27.3	31.4	35.6	39.7	43.8
15		18.7	22.8	27.0	31.1	35.3	39.4	43.5
16			22.6	26.7	30.9	35.0	39.1	43.3
17			22.4	26.5	30.6	34.8	38.9	43.1
18			22.2	26.3	30.5	34.6	38.7	42.9
19			22.0	26.2	30.3	34.5	38.6	42.7
20				26.1	30.2	34.3	38.5	42.6
21				25.9	30.1	34.2	38.3	42.5
22				25.8	30.0	34.1	38.3	42.4
23				25.8	29.9	34.0	38.2	42.3
24					29.8	34.0	38.1	42.2
25						33.9	38.0	42.2

Derived from:  $V/B = 0.5130H - 191.7455/D^2$ , above dotted line.

$V/B = 0.4136H + 520.0260/D^2$ , below dotted line.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.

Table 4. -- Volumes in board feet Scribner Rule,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet								Basis: Trees
	40	50	60	70	80	90	100	110	
----- <u>Board feet</u> -----									
10	35	49	63	77	90	104			122
11	46	63	79	96	112	129			109
12	58	78	97	117	136	156			96
13	71	94	117	140	163	182	206		52
14	85	112	138	164	188	215	242	269	39
15	100	130	161	188	219	250	281	311	27
16	116	150	181	216	252	287	322	357	36
17	133	168	208	247	287	326	366	405	19
18	151	191	236	280	324	368	412	456	20
19	167	216	265	314	363	412	461	510	8
20		242	296	350	404	458	513	567	4
21		269	328	388	448	507	567	626	5
22			362	428	493	558	623	689	5
23			398	469	540	612	683	754	4
24				512	590	667	745	822	1
25					641	725	809	893	2
Basis:	8	76	186	156	90	30	3	0	549
No. trees									

Block indicates extent of basic data.

Derived from  $V = 0.012535 D^2 H - 20.190570$ , for  $D^2 H$  to 15,000.

$V = 0.012893 D^2 H - 29.245660$ , for  $D^2 H$  larger than 15,000.

Standard errors of estimate:  $\pm 17.35$  percent;  $\pm 14.60$  percent.

Diameter classes full inch; e.g., 20-inch class includes 20.0 to 20.9.

Table 5. --Volumes in board feet Scribner Rule per square foot of basal area,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet							
	40	50	60	70	80	90	100	110
	----- Board feet -----							
10	58	81	104	127	150	173		
11	64	87	110	133	156	179		
12	68	91	114	137	160	183		
13	72	95	118	141	164	183	207	
14	74	97	120	143	164	187	211	235
15	77	100	122	143	167	190	214	238
16	78	101	122	146	169	193	217	240
17	80	101	124	148	172	195	219	243
18	81	103	126	150	173	197	221	244
19	80	104	128	151	175	199	222	246
20		105	129	153	176	200	224	247
21		107	130	154	178	201	225	248
22			131	155	179	202	226	249
23			132	156	179	203	227	250
24				157	180	204	227	251
25					181	205	228	252

Derived from:  $V/B = 2.2983H - 3701.9747/D^2$ , above dotted line.

$V/B = 2.3640H - 5362.2406/D^2$ , below dotted line.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.

Table 6. -- Volumes in board feet Scribner Rule,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Number of 16-foot logs to 8-inch top									Basis: Trees
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
----- Board feet -----										
10	42	56	70	84	98					122
11	47	64	81	98	115	132	149			109
12	53	73	93	113	133	153	173			96
13	60	83	107	130	153	176	200			52
14		94	121	148	174	201	228	255		39
15		106	136	167	197	228	259	289		27
16		118	152	187	222	257	291	326	362	36
17		131	170	209	248	287	326	366	406	19
18			188	232	275	319	364	409	453	20
19			208	256	304	354	404	453	503	8
20			228	282	335	390	445	500	556	4
21			249	308	368	429	489	550	611	5
22				337	403	469	536	602	668	5
23					439	511	584	656	728	4
24						555	634	713	791	1
25						601	686	772	857	2
Basis: No. trees	9	75	155	150	82	46	28	3	1	549

Block indicates extent of basic data.

Derived from  $V = 0.255015 D^2 H + 13.620940$ , for  $D^2 H$  to 1,100.

$V = 0.261983 D^2 H + 5.030200$ , for  $D^2 H$  larger than 1,100.

Standard errors of estimate:  $\pm 13.28$  percent,  $\pm 10.69$  percent.

Diameter classes full inch; e. g. 20-inch class includes 20.0 to 20.9.



Table 7. -- Volumes in board feet Scribner Rule per square foot of basal area,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Number of 16-foot logs to 8-inch top								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	----- <u>Board feet</u> -----								
10	69	93	116	140	163				
11	66	89	112	136	159	183	206		
12	63	86	109	133	156	180	203		
13	60	84	107	131	154	177	201		
14		82	105	129	152	176	199	222	
15		81	104	127	151	174	197	221	
16		79	103	126	149	173	196	220	244
17		78	102	125	148	172	195	219	243
18			101	124	148	171	195	219	243
19			100	123	147	171	195	219	243
20			99	123	146	170	194	218	242
21			99	122	146	170	194	218	242
22				122	146	170	194	218	242
23					146	170	194	218	242
24						170	194	218	242
25						170	194	218	242

Derived from  $V/B = 46.7574 H + 2497.4221/D^2$ , above dotted line.

$V/B = 48.0350 H + 922.2956/D^2$ , below dotted line.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.

Table 8. -- Volumes in board feet International 1/4 inch Rule,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet								Basis: Trees
	40	50	60	70	80	90	100	110	
----- Board feet -----									
10	40	57	74	90	107	124			122
11	54	74	94	113	133	153			109
12	68	92	115	139	162	186			96
13	84	111	139	166	194	219	245		52
14	101	132	164	196	225	254	283	312	39
15	119	155	191	225	258	291	324	357	27
16	138	179	219	256	294	331	368	406	36
17	159	204	247	289	331	373	415	457	19
18	180	229	276	323	371	418	465	512	20
19	203	255	308	360	412	465	517	569	8
20		283	341	399	457	514	572	630	4
21		312	375	439	503	566	630	694	5
22			412	482	551	621	691	760	5
23			450	526	602	678	754	830	4
24				572	655	737	820	903	1
25					710	799	889	978	2
Basis:	8	76	186	156	90	30	3	0	549
No. trees									

Block indicates extent of basic data.

Derived from  $V = 0.015097 D^2 H - 26.287820$ , for  $D^2 H$  to 15,000.

$V = 0.013766 D^2 H - 6.309990$ , for  $D^2 H$  larger than 15,000.

Standard errors of estimate:  $\pm 17.53$  percent;  $\pm 14.34$  percent.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.

Table 9.--Volumes in board feet International 1/4-inch Rule per square foot of basal area,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Total height in feet							
	40	50	60	70	80	90	100	110
	----- Board feet -----							
10	67	95	122	150	178	205		
11	74	102	130	157	185	213		
12	80	108	135	163	191	218		
13	84	112	140	167	195	221	246	
14	88	115	143	171	196	222	247	272
15	91	118	146	172	197	222	248	273
16	93	121	147	172	198	223	248	273
17	95	122	148	173	198	223	249	274
18	97	123	148	173	199	224	249	274
19	98	123	148	174	199	224	249	275
20		123	149	174	199	224	250	275
21		124	149	174	199	225	250	275
22			149	174	200	225	250	275
23			149	175	200	225	250	276
24				175	200	225	250	276
25					200	225	251	276

Derived from:  $V/B = 2.7681H - 4819.9157/D^2$ , above dotted line.

$V/B = 2.5240H - 1156.9472/D^2$ , below dotted line.

Diameter classes full inch; e.g., 20-inch class includes 20.0 to 20.9.

Table 10. -- Volumes in board feet International 1/4-inch Rule,  
lodgepole pines in Colorado and Wyoming

Board feet inside bark

Top diameter 8 inches inside bark

Merchantable stem excluding stump and top

Stump height 1.0 foot

Diameter breast height outside bark (inches)	Number of 16-foot logs to 8-inch top									Basis: Trees
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
----- Board feet -----										
10	49	66	82	99	116					122
11	56	76	96	116	136	156	175			109
12	63	87	110	134	157	181	204			96
13	71	98	126	153	181	208	236			52
14		111	143	174	206	238	269	301		39
15		125	161	197	233	269	306	338		27
16		139	180	221	262	303	340	377	414	36
17		154	201	247	293	336	377	419	460	19
18			222	274	324	370	416	463	509	20
19			245	302	354	406	457	509	560	8
20			269	330	387	444	501	558	614	4
21			295	358	421	484	546	609	671	5
22				388	457	525	594	662	731	5
23					494	569	644	718	793	4
24						614	696	777	858	1
25						662	750	838	926	2
Basis:										
No. trees	9	75	155	150	82	46	28	3	1	549

Block indicates extent of basic data.

Derived from  $V = 0.301244 D^2 H + 16.069730$ , for  $D^2 H$  to 1,000.

$V = 0.270735 D^2 H + 45.578690$ , for  $D^2 H$  larger than 1,000.

Standard errors of estimate:  $\pm 13.50$  percent;  $\pm 10.23$  percent.

Diameter classes full inch; e.g., 20-inch class includes 20.0 to 20.9.



Table 11. -- Volumes in board feet International 1/4-inch Rule per square foot of basal area, lodgepole pines in Colorado and Wyoming

Board feet inside bark  
Merchantable stem excluding stump and top

Top diameter 8 inches inside bark  
Stump height 1.0 foot

Diameter breast height outside bark (inches)	Number of 16-foot logs to 8-inch top								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	----- Board feet -----								
10	82	110	137	165	192				
11	78	105	133	160	188	216	243		
12	74	102	129	157	185	212	240		
13	71	99	127	154	182	209	237		
14		97	124	152	180	207	235	263	
15		95	123	150	178	206	233	258	
16		94	121	149	177	204	229	254	279
17		92	120	148	175	201	226	251	275
18			119	147	173	198	223	248	273
19			118	146	171	196	221	245	270
20			117	144	169	194	218	243	268
21			117	142	167	192	217	241	266
22				141	165	190	215	240	265
23					164	189	214	239	263
24						188	212	237	262
25						187	211	236	261

Derived from  $V/B = 55.2336 H + 2946.4118/D^2$ , above dotted line.

$V/B = 49.6397 H + 8356.9289/D^2$ , below dotted line.

Diameter classes full inch; e. g., 20-inch class includes 20.0 to 20.9.

Table 12. -- Tree volumes per square foot of basal area by tree height classes only, lodgepole pines in Colorado and Wyoming

Tree height (feet)	Merchantable cubic feet	Board feet		Tree height (logs)	Board feet	
		Scribner	International		Scribner	International
30	10.3	--	--	1.0	68	80
40	15.9	67	78	1.5	91	108
50	22.9	87	103	2.0	112	132
60	28.3	113	134	2.5	133	156
				3.0	153	179
70	32.5	138	163	3.5	174	203
80	36.1	163	192	4.0	196	226
90	39.8	190	221	4.5	219	250
100	43.5	219	250	5.0	242	275

Table 13. --Percentage of total board-foot volume in each log of a tree,  
lodgepole pines in Colorado and Wyoming

Diameter breast height outside bark (inches) and tree height (logs)	Position of log in the tree									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	
----- <u>Percent of total tree volume</u> -----										
Trees 10 inches d. b. h.:										
1.0	100									
1.5	72	28								
2.0	58	--	42							
2.5	48	--	36	16						
3.0	41	--	31	--	28					
3.5	36	--	27	--	25	12				
Trees 14 inches d. b. h.:										
1.5	76	24								
2.0	65	--	35							
2.5	55	--	34	11						
3.0	47	--	33	--	20					
3.5	41	--	31	--	21	7				
4.0	37	--	30	--	22	--	11			
Trees 18 inches d. b. h.:										
2.0	75	--	25							
2.5	64	--	29	7						
3.0	55	--	33	--	12					
3.5	47	--	32	--	16	5				
4.0	42	--	29	--	21	--	8			
4.5	38	--	25	--	25	--	8	4		
Trees 22 inches d. b. h.:										
2.5	75	--	20	5						
3.0	61	--	28	--	11					
3.5	50	--	32	--	14	4				
4.0	45	--	29	--	20	--	6			
4.5	41	--	26	--	21	--	9	3		
5.0	38	--	25	--	22	--	12	--	3	

Myers, Clifford A.

1964. Volume tables and point-sampling factors for lodgepole pine in Colorado and Wyoming. U. S. Forest Serv. Res. Paper RM-6, 16 pp. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Volumes are in total cubic feet and cubic feet to a 4.0-inch top, board feet Scribner Rule to an 8-inch top, and board feet International 1/4-inch Rule to an 8-inch top. Tree heights are in feet and numbers of logs. Volume equations are of the form  $V = a + bD^2H$ .

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